

NEW DESULFURIZATION TECHNOLOGY FOR SO_x REDUCTION WITH POSITIVE NET ENVIRONMENTAL IMPACT BASED ON MgO REAGENTS

Acronym: LIFEPOSITIVEMgOFGD



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1. INTRODUCTION

Apart from policies related to industrial emissions, such as the IED, which is the main focus of the project, there are also synergies with other policies such as the Circular Economy Action Plan, Clean Air Policy and Raw Materials Policy. The utilization of mining waste to produce the sorbent used and the utilization of the by-product, are recycle/reuse activities which broaden the policy scope of the project. In the current deliverable, the policy synergies are analysed and the relevant environmental benefits quantified.

2. SYNERGIES WITH EU POLICIES

2.1 INDUSTRIAL EMISSIONS

National Emission Ceilings Directive (2001/81/EC) sets pollutant-specific and legally binding emission ceilings for various gaseous pollutants (including SO_x) for each EU Member State. The directive sets specific environmental objectives that address the impacts of acidification and eutrophication on ecosystems, and the harmful effects of ozone on vegetation and human health. In particular it sets 'reduction commitments' applicable from 2020 and from 2030 onwards.

The EU regulates the operation of various industrial activities in order to implement its policy and protect the environment. One of the main instruments available is the aforementioned Industrial Emissions Directive (IED, 2010/75/EU) and one of its aims is the adoption of the best available techniques (BAT) for pollution control as described in reference documents or BREFs, particular to each industrial sector. The Magnesia or magnesium oxide (MgO) production industrial sector (where Grecian Magnesite belongs to) is regulated by the IED and the relevant BREF is the so-called Cement-Lime-Magnesia or CLM BREF and associated BAT.

LIFEPOSITIVEMgOFGD demonstrates that the relevant SO_x emission limit values of the CLM BREF are achievable by using MgO as desulfurization reagent in the context of a specially designed dry abatement technique. During its After-LIFE period, it plans to intervene and include the description of the technology and its results in the CLM BREF during its next revision through the CLM Technical Working Group set up by the European IPPC Bureau (EIPPCB). The process is supposed to start 8 years after the previous BREF version; therefore it is expected in 2021. GM will pursue participation in the TWG, a fact that would greatly facilitate intervention. In preparation for this inclusion, apart from EIPPCB, GM has implicated:

D-G Environment: C.3-Clean Air and C.4-Industrial Emissions and Safety

National associations:

- Hellenic Federation of Enterprises (SEV)
- Greek Mining Enterprises Association (GMEA)

Other stakeholders:

- EIT Raw Materials
- European Association of Mining Industries, Metal Ores & Industrial Minerals (Euromines)
- TIMAB



- Magnesitas Navarras
- Magnesitas de Rubian
- RHI
- Lehvoss
- Nedmag
- Calix
- Ternamag
- Yara Fertilisers
- TIMAC Agro
- Knauf Austria
- General Abrasivi
- Greek Public Power Corporation
- CaO Hellas
- TITAN
- AGET
- Greek Lime Federation
- Solvay

2.2 RAW MATERIALS

Taken together, raw materials and their directly related industries in 2012 provided EUR 280 billion of added value and more than four million jobs. However, the economic importance of the raw materials sector goes far beyond the economic activities strictly related to the extractive and processing industries. Looking at the metals value chain alone, the secure supply of raw materials is essential for jobs in many downstream manufacturing sectors. These include the production of fabricated metal products, electronics, and machinery and equipment. It is estimated that more than 11 million jobs are affected, equal to 40 % of the jobs and value added from the EU's entire manufacturing sector. More than 11 million jobs in manufacturing industries depend on the secure supply of raw materials.

The European Innovation Partnership (EIP) on Raw Materials, as a stakeholder platform that brings together representatives from industry, public services, academia and NGOs, continues to be the best available tool to develop a new SIP (Strategic Implementation Plan) for 2020–2030. It provides high-level guidance on innovative approaches to challenges related to raw materials. Its key objectives are, a) Sustainability, b) Economic resilience, c) Technological leadership, while its key measures include:

- Ensuring base load supply for the EU economy and reducing import dependencies
- Enabling EU strategic policies (Decarbonisation, Switching to Renewables, Smart transportation and buildings,
- Sustainable value chains Economic resilience and competitiveness Better regulation and better implementations)
- New jobs in the raw materials and its service sectors
- EU cohesion by regional revitalization



- “Equivalent conditions” for imports and exports of raw materials
- Sustainable resource management from cradle to grave

Bringing together various players is important because raw materials supply is characterised by interlinked complex value chains. Therefore, raw materials production processes should not be considered in isolation. Even small regulatory changes can have a positive or negative impact far beyond the raw materials sector.

On 22nd October 2018 the EU’s Competitiveness Council recalled the horizontal mandate given to the Competitiveness Council with respect to enhancing competitiveness and growth, to review on a regular basis both horizontal and sectoral issues and to be effectively consulted on proposals considered likely to have substantial effects on competitiveness, alongside the responsibility of all Council formations to assess the impact of their work field. The EU’s Raw Materials Supply Group is the EU’s permanent working group on the extractive industry and its competitiveness. The RMSG needs to assess the cumulative effect of the latest EU legislation as well as revisions in national policies and revised mining legislation in comparison to the international situation as well as in light of the strategic industrial policies at EU and national levels. Countries are interdependent on a series of raw materials and therefore a continued dialogue and assessment is crucial in order to achieve the declared EU’s industrial policy goals (see Figure 1).

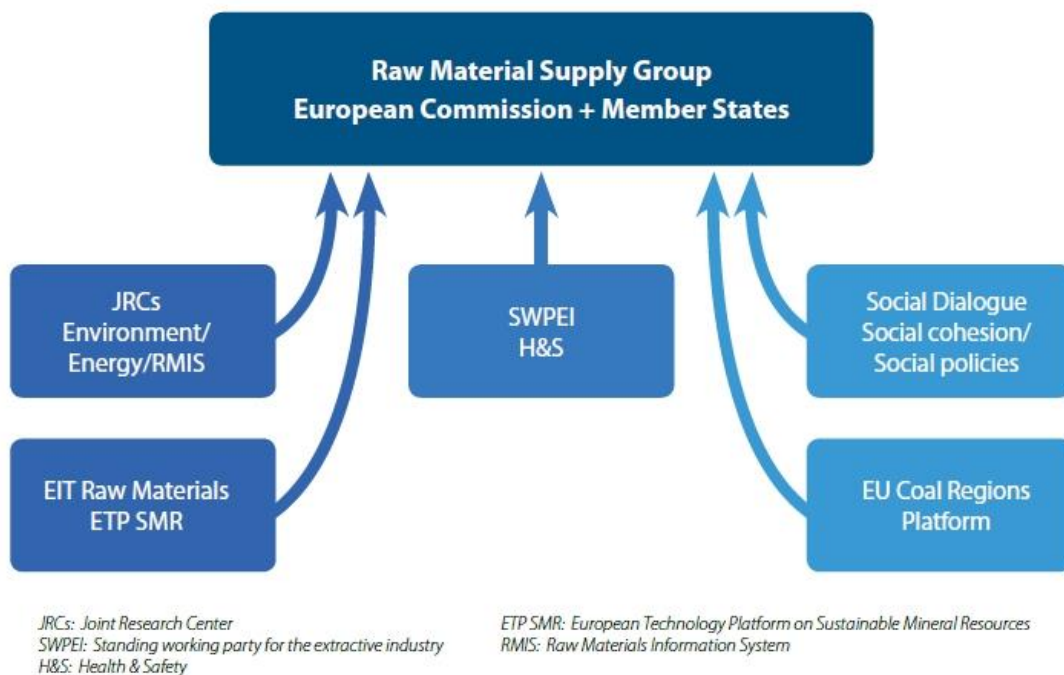


FIGURE 1: RAW MATERIAL SUPPLY GROUP INPUTS

EIT Raw Materials is the largest and strongest consortium in the raw materials sector worldwide. Its vision is a European Union where raw materials are a major strength. Its mission is to boost competitiveness, growth and attractiveness of the European raw materials sector via radical innovation and guided entrepreneurship.

LIFEPOSITIVEMgOFGD is in synergy with Raw Material policies through its activities in the utilization of mining waste to produce the sorbent and the utilization/valorization of the by-product. Grecian Magnesite participated in the EIT Raw Materials event, *EIT RawMaterials: 3rd Greek Raw Materials Community Dialogue*, organized by the

EIT RawMaterials HUB – Regional Center Greece – (RCGREECE), in December 4-5, 2018, in Athens, Greece. GM presented its activities in Magnesite recovery from old tailings and how this ties in with the LIFEPOSITIVEMgOFGD project. The main target of the Regional Center Greece is to engage and stimulate the Greek Raw Materials Community through actions on multiple directions (technical as well as non-technical), in order to resolve issues and strengthen the overall position of the sector in Greece as well as internationally.

2.3 RESEARCH AND INNOVATION IN THE MEDITERRANEAN AREA (PRIMA)

In recent years, the agricultural sector in the Mediterranean has been suffering from severe water shortages and decreasing crop yields. Today, 180 million people in the Mediterranean basin are considered 'water poor'. The lack of clean water and nutritious food has adverse effects on the health and stability of the populations.

A new Partnership on Research and Innovation in the Mediterranean Area (PRIMA) will develop much-needed solutions for a more sustainable management of water and agro-food systems. The main objective of the ten-year initiative (2018 – 2028), which is partly funded by EU's research and innovation programme Horizon 2020, is to devise new R&I approaches to improve water availability and sustainable agriculture production in a region heavily distressed by climate change, urbanisation and population growth. PRIMA Strategic Research and Innovation Agenda (SRIA) covers the following priorities:

- Integrated and sustainable management of water for arid and semi-arid Mediterranean areas (Water Management),
- Sustainable farming systems under Mediterranean environmental constraints (Farming systems),
- Sustainable Mediterranean agro-food value chain for regional and local development (Agro-food Value Chain)

LIFEPOSITIVEMgOFGD being a low water consumption SO_x abatement solution (**96% less water consumption** than conventional wet-FGD processes) could be a viable solution for arid areas with water shortages and in this respect could find synergy with PRIMA.

2.4 THE CLEAN AIR POLICY PACKAGE

The Clean Air Policy Package includes legislative proposals that are presently being considered by the European Parliament and Council. The main elements of this air quality policy package, i.e. the air pollutants it focusses on, their respective sources and origins, the scope for taking action and the benefits this would render for health, economy and environment.

The LIFEPOSITIVEMgOFGD project has been included in the JRC - Air Quality Measures Catalogue: <http://fairmode.jrc.ec.europa.eu/measure-catalogue/> linked with the Clean Air Policy initiative.



2.5 CIRCULAR ECONOMY ACTION PLAN

Circular Economy Action Plan adopted by the Commission on 2 December 2015, has created an important momentum to support the transition towards a more circular economy in the EU. This package included legislative proposals on waste, with long term targets to reduce landfilling and increase recycling and reuse. In order to close the loop of product lifecycles, it also included an Action Plan to support the circular economy in each step of the value chain – from production to consumption, repair and manufacturing, waste management and secondary raw materials that are fed back into the economy.

European Circular Economy Stakeholder Platform Contribution: GM submitted information in the Good Practice section of the website <https://circulareconomy.europa.eu/platform/en/good-practices> on April 9th 2019. However, the submission was considered as premature by the platform and there will be an updated submission at the start of the After LIFE period.

3. ANALYSIS: RAW MATERIALS SUBSTITUTION AND SAVINGS

3.1 SO₂ EMISSIONS SAVINGS

The pilot plant treats 84.000 m³/h of flue gases. SO_x emissions are reduced by 51%, achieving a value of less than 1.500 mg of equivalent SO₂ per normal m³, which is the current BAT Emission Limit Value. In absolute terms, **520 tons of equivalent SO₂** are prevented to escape in the atmosphere every year.

3.2 RAW MATERIALS SAVINGS

Sorbent production

The sorbent required for the pilot plant is produced on-site, as GM takes advantage of old mine stockpiles (practically non-valorisable mining waste) containing quantities of magnesite (MgCO₃) the raw material required to produce MgO, the sorbent used at the FGD plant. To get the valuable magnesium carbonate in the pile, GM gets rid of the unwanted minerals also contained therein through a rather simple process utilising the scheme depicted in Figure 2. This saves Magnesite resources that would have to be freshly mined at higher costs and environmental impact. For example, this saves 72 kg equivalent CO₂ (i.e. saving excavation/transport vehicle fuel and beneficiation installation electricity) for every ton of resource saved.



FIGURE 1: RECYCLING OF OLD MINING WASTE

By-product and its valorisation

The pilot plant's by-product is a fine powder and mixture of magnesium oxide and the desulfurization by-products, mainly sulphite and sulphate salts. These characteristics make the by-product valuable for a variety of possible applications such as raw material for magnesium cements in construction products or as raw material for fertilizer production. In particular, Grecian Magnesite has made extensive testing to fully characterize the by-product and its properties and has prepared a comprehensive magnesium cement test report and a report on fertilizer application tests. The by-product can be used to prepare the magnesium cement that is used in the manufacture of panels and has been initially approved by a major European panel manufacturer.

Currently, 15% of the generated by-product is valorized on-site, by mixing it with a commercial Grecian Magnesite MgO grade, with favorable results, sold for cement applications such as panels and abrasives. The target is to **increase valorisation up to 90%**. This indirectly saves raw material consumption and CO₂ emissions (from the calcination of the material and the associated fuel combustion) that would occur if these volumes were conventionally produced.

4. CONCLUSIONS

The current project has several synergies with other EC initiatives and policies. Policy impact will be increased during the After LIFE period, with the further communication of the projects results and the CLM BREF review. In the meantime, considerable savings in related air emissions and raw materials have been achieved and are expected to increase during the After-LIFE period.